



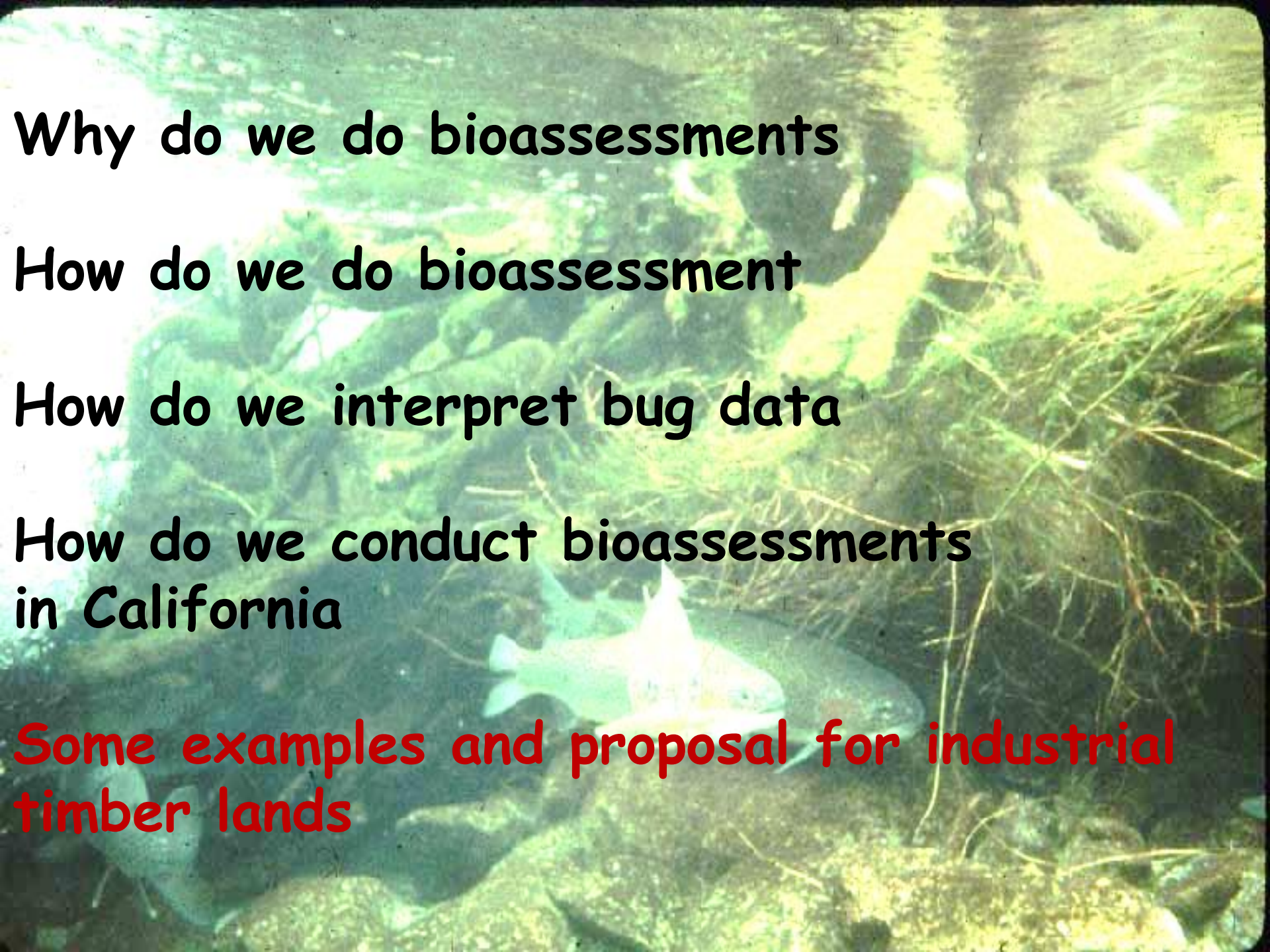
**MSG BOF Meeting 9-19-12**  
**Jim Harrington**  
**CDFW Aquatic Bio-Assessment Lab**  
**Cajun James**  
**Sierra Pacific Industries**

Achieving regulatory biological objectives  
in California



**October 2014**  
**4 Locations Bio-Assessment Protocol**  
**Harrington (Field Staff) & SPI**  
**Greater Battle Creek Working Group (Tussing)**



An underwater photograph showing a school of fish swimming near a rocky seabed covered with green seaweed and other marine plants. The water is clear, and the lighting is natural, coming from above.

**Why do we do bioassessments**

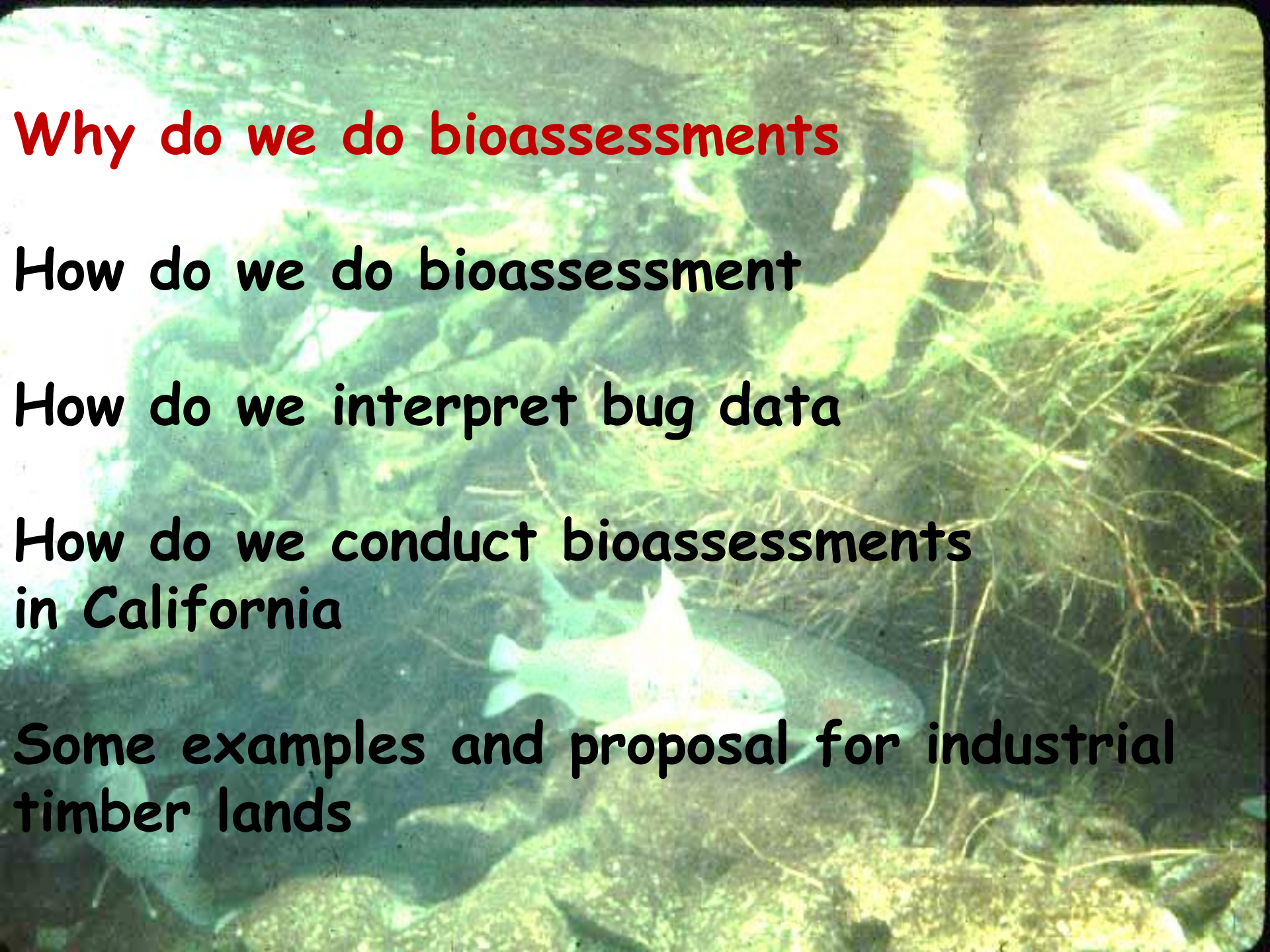
**How do we do bioassessment**

**How do we interpret bug data**

**How do we conduct bioassessments  
in California**

**Some examples and proposal for industrial  
timber lands**



An underwater photograph showing a school of fish swimming over a rocky seabed covered in green seaweed. The water is slightly murky, and the lighting is natural, coming from above.

**Why do we do bioassessments**

**How do we do bioassessment**

**How do we interpret bug data**

**How do we conduct bioassessments  
in California**

**Some examples and proposal for industrial  
timber lands**



# California Department of Fish and Wildlife

## Hot Creek Hatchery NPDES Permit



1993 in permit

Waited for response

1999-2004

2005 SI process

Continue monitoring

# 1993-95 Pilot Monitoring Study

## BIOLOGICAL CONDITION OF STUDY REACHES BASED ON MACRO-INVERTEBRATE FAUNAS

<u>Score</u>	<u>Reach</u>
<u>Group 1 (COMPLEX)</u>	
45	Upper Pudding Creek (Noyo Watershed)
43	Sweetwater Creek (Mokelumne Watershed)
39.5	Tiger Creek (Mokelumne Watershed)
37	Noyo River (Noyo Watershed)
35.5	Mill Creek (Mokelumne Watershed)
<u>Group 2</u>	
31.5	Doty Creek (Gualala Watershed)
29	Solinsky Crossing (Mokelumne Watershed)
<u>Group 3 (SIMPLE)</u>	
21	North Fork Gualala River (Gualala Watershed)
17.5	Lower Pudding Creek (Noyo Watershed)
13.5	Cottonwood Creek (Siskiyou Watershed)
12.5	Log Cabin Creek (Gualala Watershed)

Obviously, this ranking should be taken with a degree of caution. Without comparison to differences in habitat parameters, the biological significance of the groupings is not clear.

Subsampling 100 macro-invertebrates from a sample is recommended in the national RBPs (Plafkin et al 1989). The total number of macro-invertebrates in 11 samples examined ranged from 138 to 3950 with an average of 1140. Subsampling effected the metric values from 0 to 300% and the degree of difference was related to the difference in abundance (Appendix N, Table 7). In spring 1994, subsampling was increased to 300 to improve metric reliability. Metric values increased substantially (Appendix N, Table 2 and 3), but there was no difference in the coefficients of variation (Table 5 and 6). For 12 of the spring 1994 samples, there were less than 300 organisms. The lowest number was 134 but there was no noticeable effect to the metric value or variability.

A strong correlation could not be detected between bioassessment metric values and physical/habitat scores. This may be because the generalized visual evaluation was not quantitative or there was inconsistency in implementing the field procedures. The macro-invertebrate community appears to be more responsive to upstream influences than those in the immediate area. There were also inconsistencies between information indices generated for the streams visited in fall 1993 and spring 1994.

The bioassessment metrics taxa richness, diversity index and EPT index seem to be reliable indicators of biological conditions. The biotic index had low variability which is indicative of a useful metric, but may not be a relevant metric for forested streams since it was developed for an indicator of organic pollution. Dominant taxa had the highest variability and its usefulness may be questionable.

The effectiveness of the physical/habitat evaluation procedure originally recommended by the EPA (Plafkin et al. 1989) was not determined in this study. Low-level ocular physical assessment

## PILOT MONITORING PROGRAM DFG-IN STREAM COMPONENT

DATA FORM 5A VMP\_01\FORM5MACRO.D01 (3 MAY 1994)

## STREAM BIOASSESSMENT

STREAM REACH \_\_\_\_\_ WATERSHED \_\_\_\_\_ SAMPLE ID \_\_\_\_\_

RIFFLE # \_\_\_\_\_ DATE \_\_\_\_\_ TIME \_\_\_\_\_ WPCL # \_\_\_\_\_

WATER TEMP (°C) \_\_\_\_\_

RIFFLE LENGTH (m) \_\_\_\_\_

TRANSECT INTERSECT \_\_\_\_\_

#1 (m.cm) \_\_\_\_\_

#2 (m.cm) \_\_\_\_\_

#3 (m.cm) \_\_\_\_\_

CREW MEMBERS \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

HABITAT ASSESSMENT PARAMETERS  
(FILL IN AFTER FIELD DATA REVIEW)  
(REFER TO HANDOUT FOR DEFINITIONS)

1. BOTTOM SUBSTRATE \_\_\_\_\_

2. INSTREAM COVER \_\_\_\_\_

3. EMBEDDEDNESS \_\_\_\_\_

4. VELOCITY / DEPTH \_\_\_\_\_

5. CHANNEL SHAPE \_\_\_\_\_

6. POOL / RIFFLE RATIO \_\_\_\_\_

7. WIDTH / DEPTH RATIO \_\_\_\_\_

8. BANK VEGETATION \_\_\_\_\_

9. LOWER BANK STABILITY \_\_\_\_\_

10. DISRUPTIVE PRESSURES \_\_\_\_\_

11. ZONE OF INFLUENCE \_\_\_\_\_

COMMENTS \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

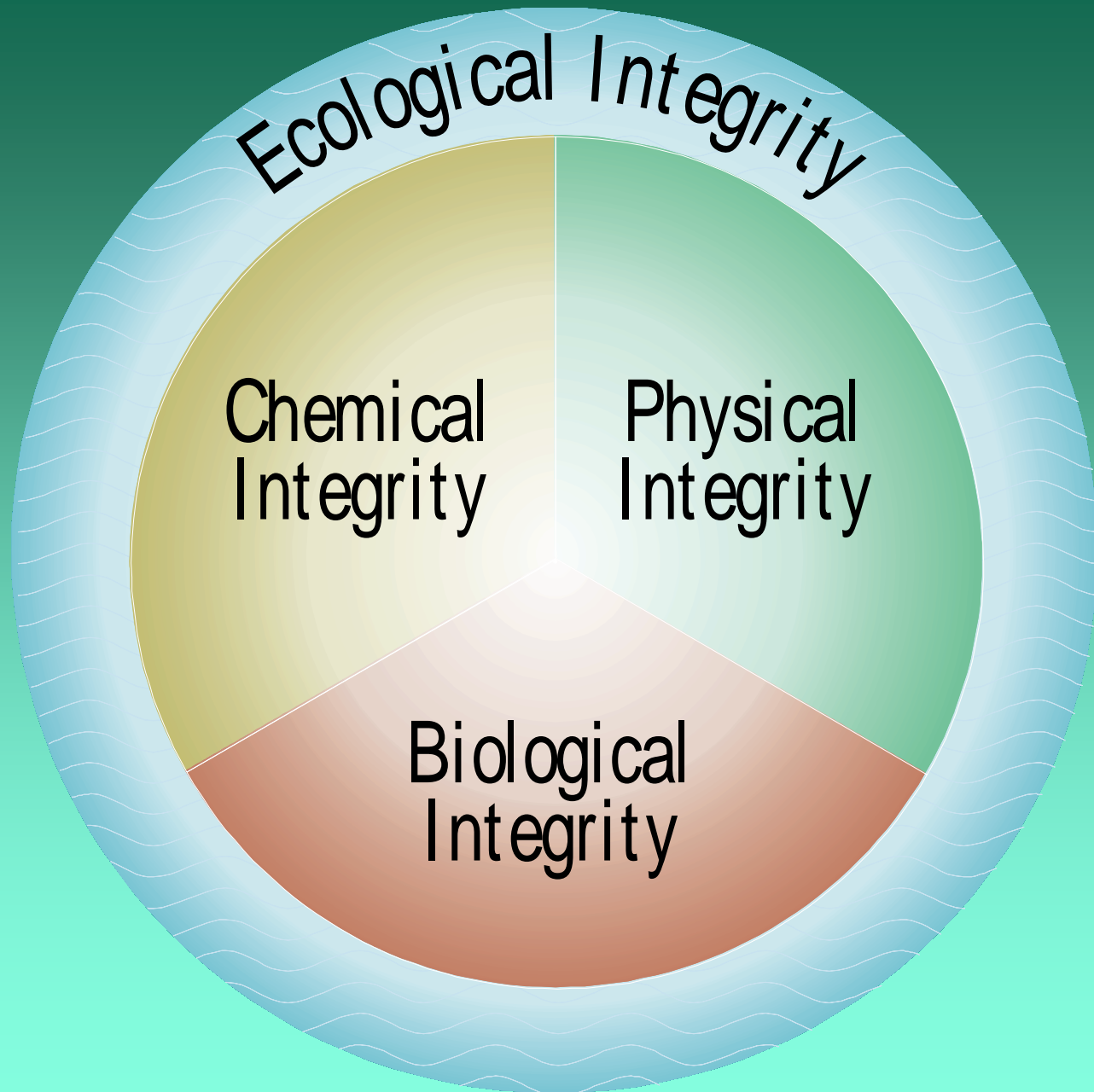
\_\_\_\_\_

\_\_\_\_\_

CHAIN OF CUSTODY

COLLECTOR	RELEASED BY	RECEIVED BY	DATE
TRANSPORTER	_____	_____	_____
TRANSPORTER	_____	_____	_____
TRANSPORTER	_____	_____	_____

Sampled 11 sites in 3 watersheds  
Purchased field and lab equipment  
Tested field and lab methods  
Modified US EPA methods for Cal needs  
Was standard protocol until 2007



# Statutory Authority

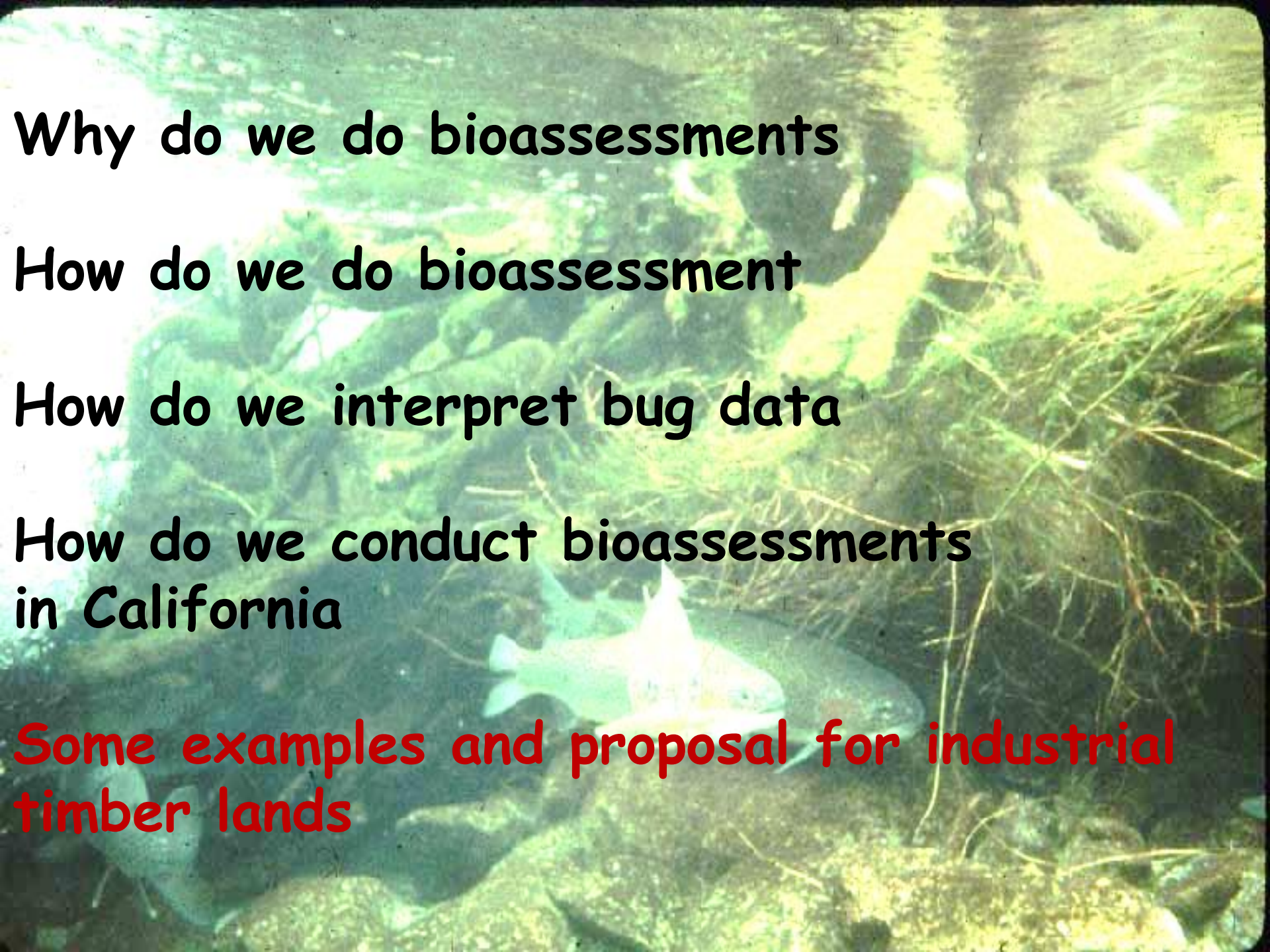
- Clean Water Act Section 101(a) Purpose:
  - *"To restore and maintain the **chemical, physical and biological integrity** of the Nation's waters"*





Biological integrity - the capability of the waterbody to support and maintain a balanced, integrated, adaptive **community of organisms** having a composition and diversity comparable to that of **natural habitats** of the region



An underwater photograph showing a school of fish swimming near a rocky seabed covered with green seaweed. The water is slightly murky, and the lighting is natural, coming from above.

Why do we do bioassessments

How do we do bioassessment

How do we interpret bug data

How do we conduct bioassessments  
in California

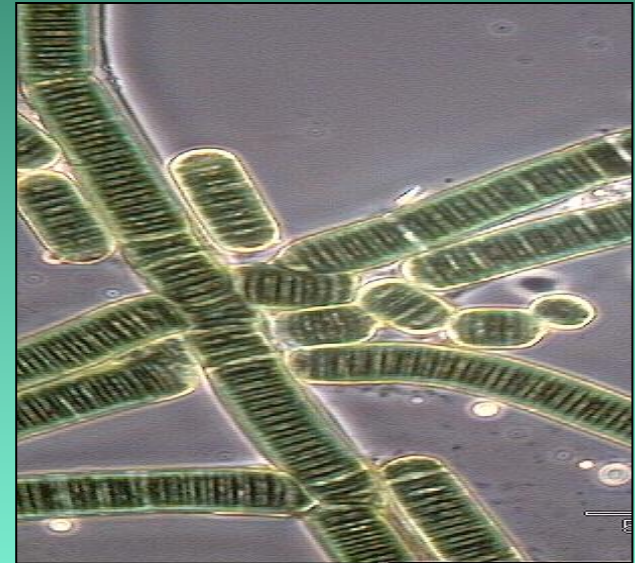
Some examples and proposal for industrial  
timber lands



# FRESHWATER BIOASSESSMENT - THE USE OF AQUATIC ORGANISM TO MEASURE AQUATIC HEALTH -

US EPA Recommendation:

Multiple Assemblages  
Fish, Invertebrates and Algae



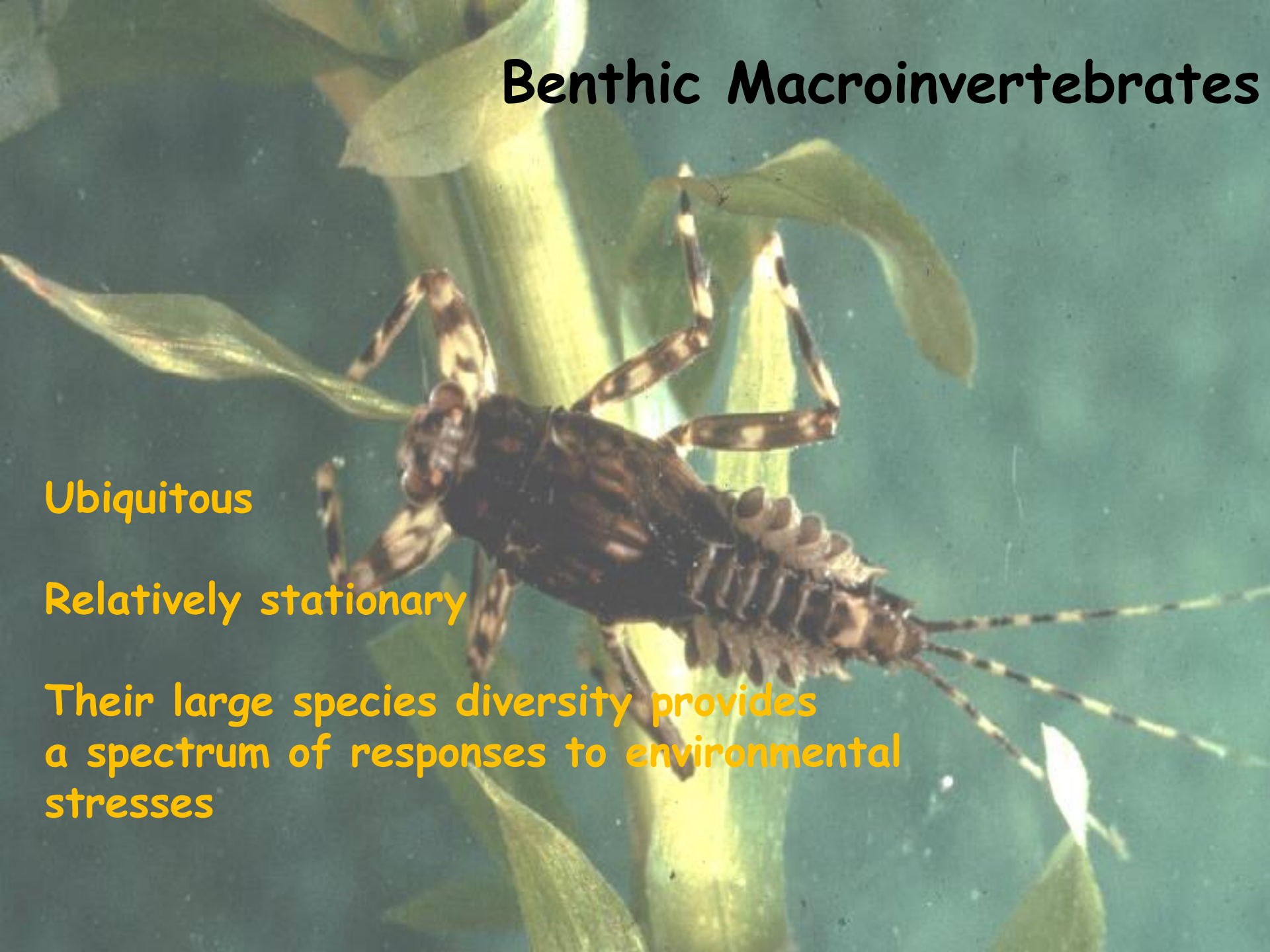


# Benthic Macroinvertebrates

Ubiquitous

Relatively stationary

Their large species diversity provides  
a spectrum of responses to environmental  
stresses



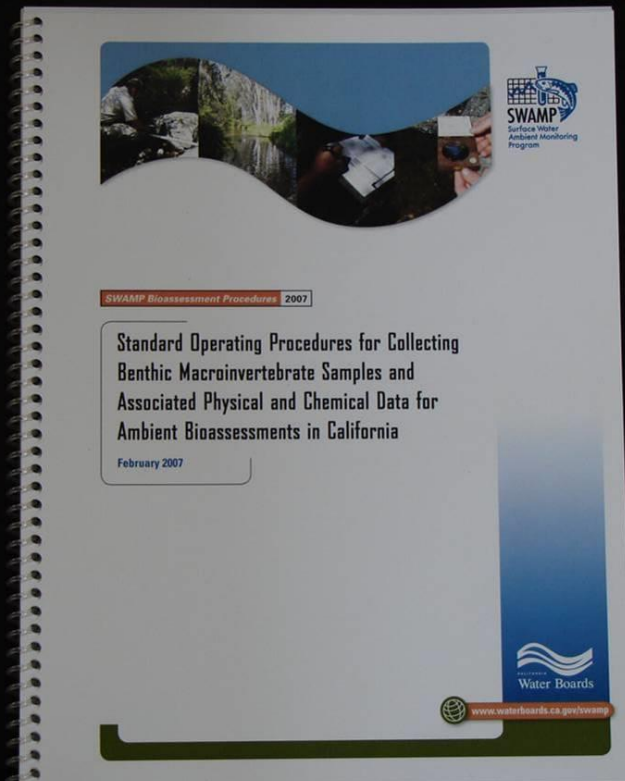


# SWAMP Bioassessment Procedures

Collect BMIs

Measure Phab

Measure Basic  
Chemistry











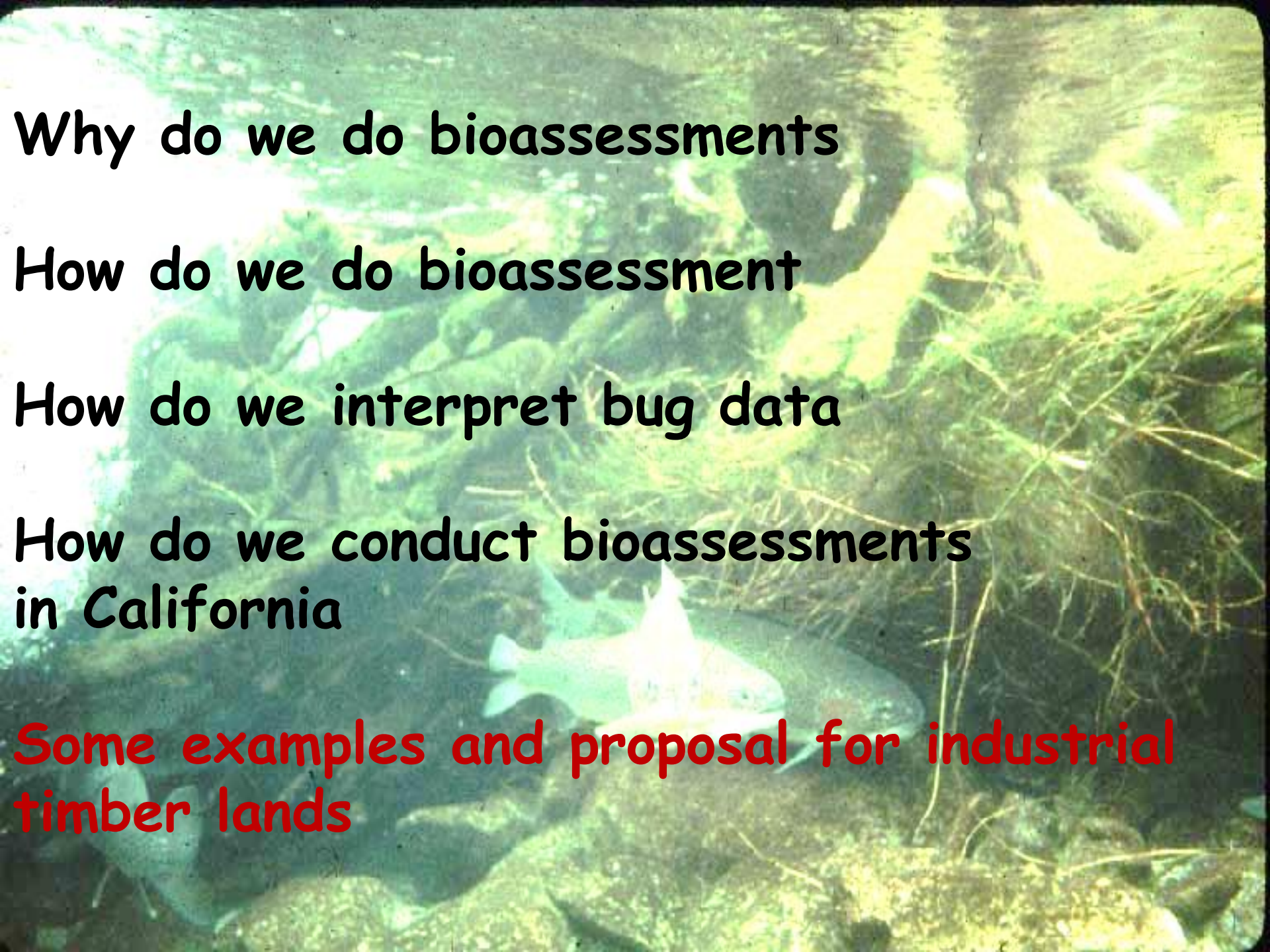










An underwater photograph showing a school of fish swimming over a rocky seabed covered in green seaweed. The water is slightly murky, and the lighting is natural, coming from above.

Why do we do bioassessments

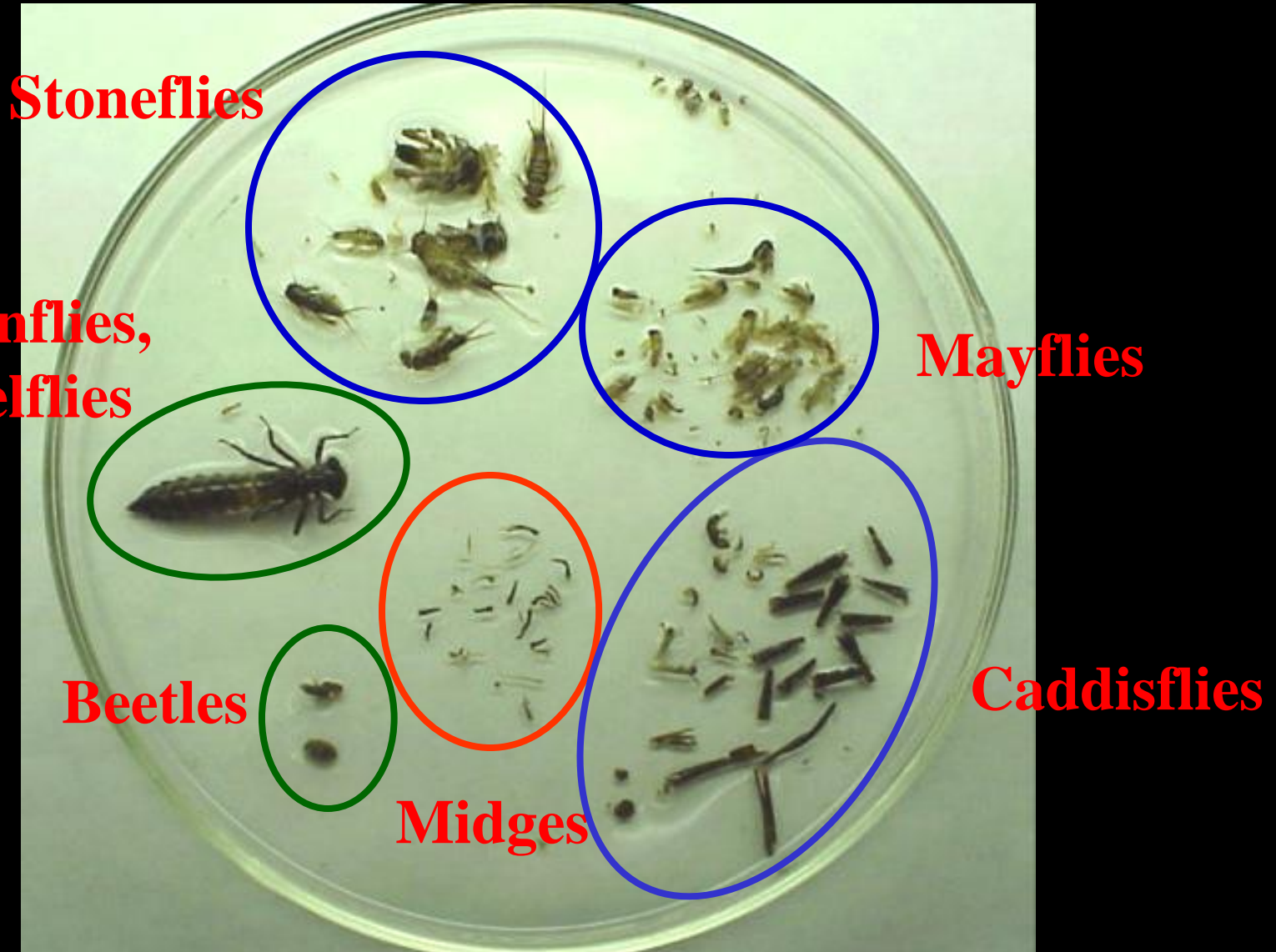
How do we do bioassessment

How do we interpret bug data

How do we conduct bioassessments  
in California

Some examples and proposal for industrial  
timber lands

End Product - 600 subsampled BMIs from the sample reach





# Sensitive Organisms in Streams

## Dragonflies and Damselflies



## Mayflies



## Stoneflies



## Caddisflies



Expected Response to Stress: ↓ abundance & proportion

# Tolerant Organisms in Streams

**Scuds**



**Snails**



**Leeches**



**Midges**



Expected Response to Stress: ↑ abundance & proportion



# Types of BMI Metrics

## **Richness Measures**

EPT Taxa

## **Composition Measures**

Percent EPT Individuals

## **Tolerance/Intolerance Measures**

Percent Sensitive EPT Taxa

## **Functional Feeding Groups**

Percent Shredder Taxa

Total of 134

SAFIT Standard Taxonomic Effort I & II

# Algae Bioassessment: Supporting Documents



Draft Technical Report

2008

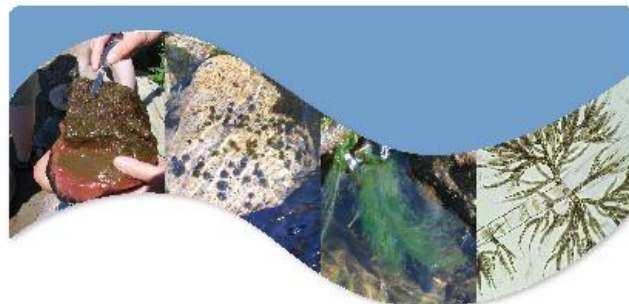
Incorporating Bioassessment Using Freshwater Algae  
into California's Surface Water Ambient Monitoring  
Program (SWAMP)

California's  
"Algae Plan"

March 2008



[www.waterboards.ca.gov/swamp](http://www.waterboards.ca.gov/swamp)



SWAMP Algae Field SOP 2009

Standard Operating Procedure  
for Collecting Stream Algae Samples  
and Associated Physical Habitat  
and Chemical Data for Ambient  
Bioassessments in California

July 2009

**A. Elizabeth Fetscher**

Southern California Coastal Water Research Project  
3535 Harbor Blvd., Suite 110  
Costa Mesa, CA 92622

**Lilian Busse**

San Diego Regional Water Quality Control Board  
State Water Resources Control Board  
9174 Sky Park Court  
San Diego, CA 92123

**Pete Ode**

Aquatic Bioassessment Laboratory/Water Pollution Control Laboratory  
Department of Fish and Game  
2005 Nimbus Road  
Rancho Cordova, CA 95670

**SWAMP**  
**Algae**  
**Field SOP**  
**June 2009**  
**(updated**  
**May 2010)**



[http://www.waterboards.ca.gov/water\\_issues/programs/swamp](http://www.waterboards.ca.gov/water_issues/programs/swamp)



An underwater photograph showing a school of fish swimming over a rocky seabed covered in green seaweed. The water is slightly murky, and the lighting is natural, coming from above.

Why do we do bioassessments

How do we do bioassessment

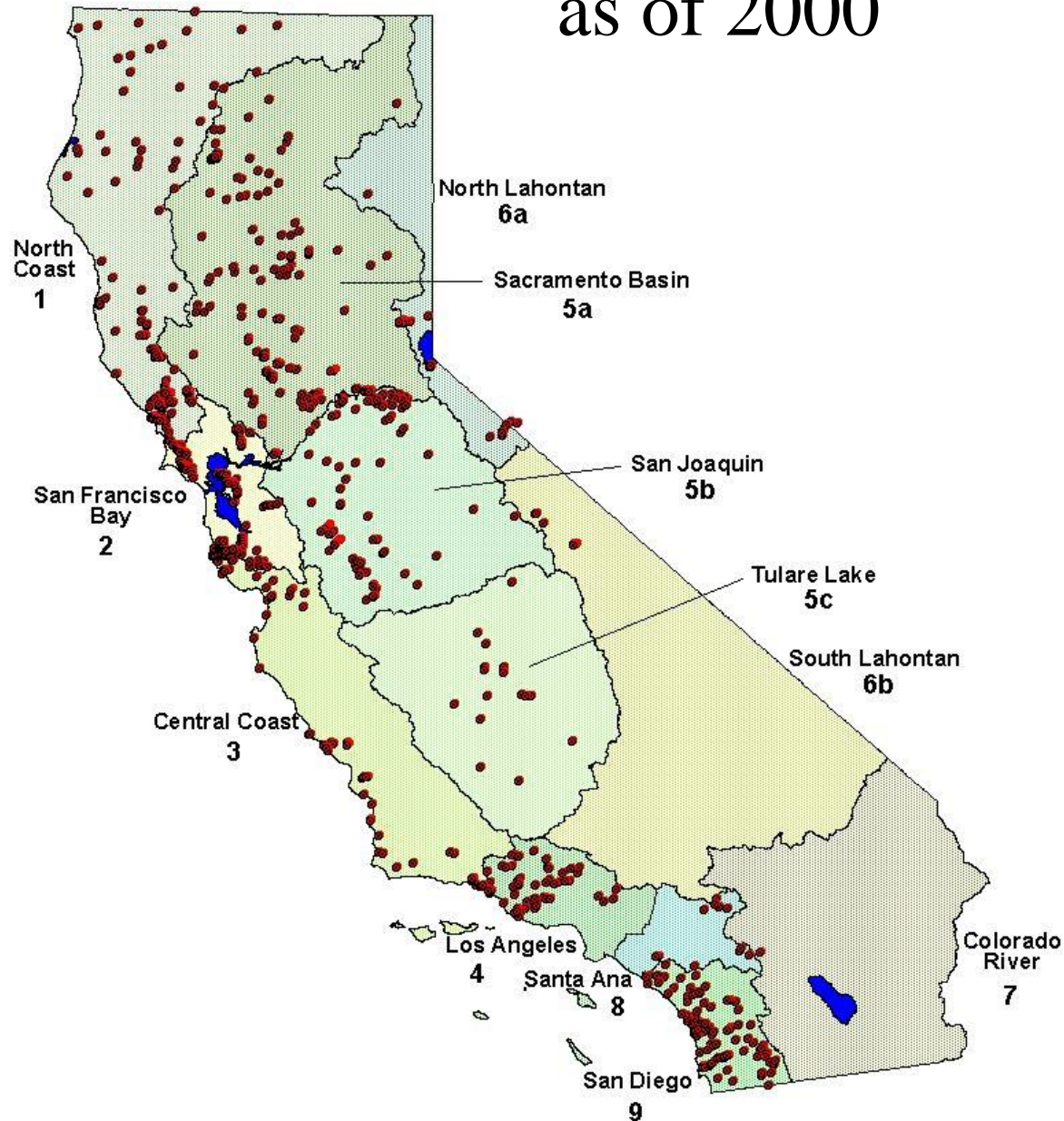
How do we interpret bug data

How do we conduct bioassessments  
in California

Some examples and proposal for industrial  
timber lands



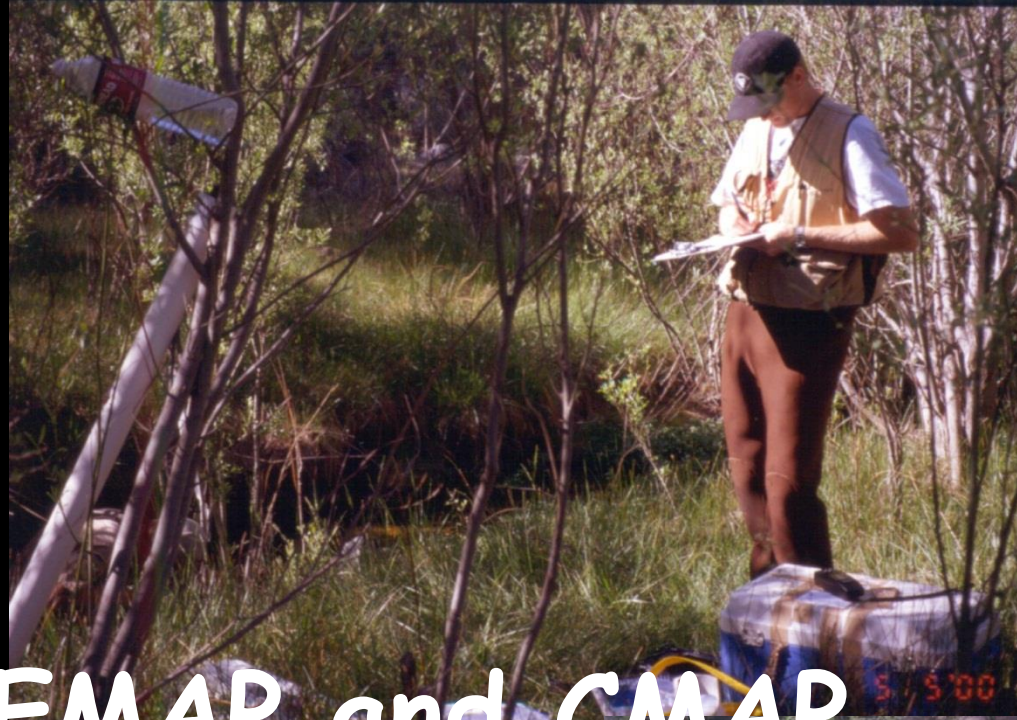
# Targeted Sampling Site from Various Special Studies as of 2000





2000  
through  
2007

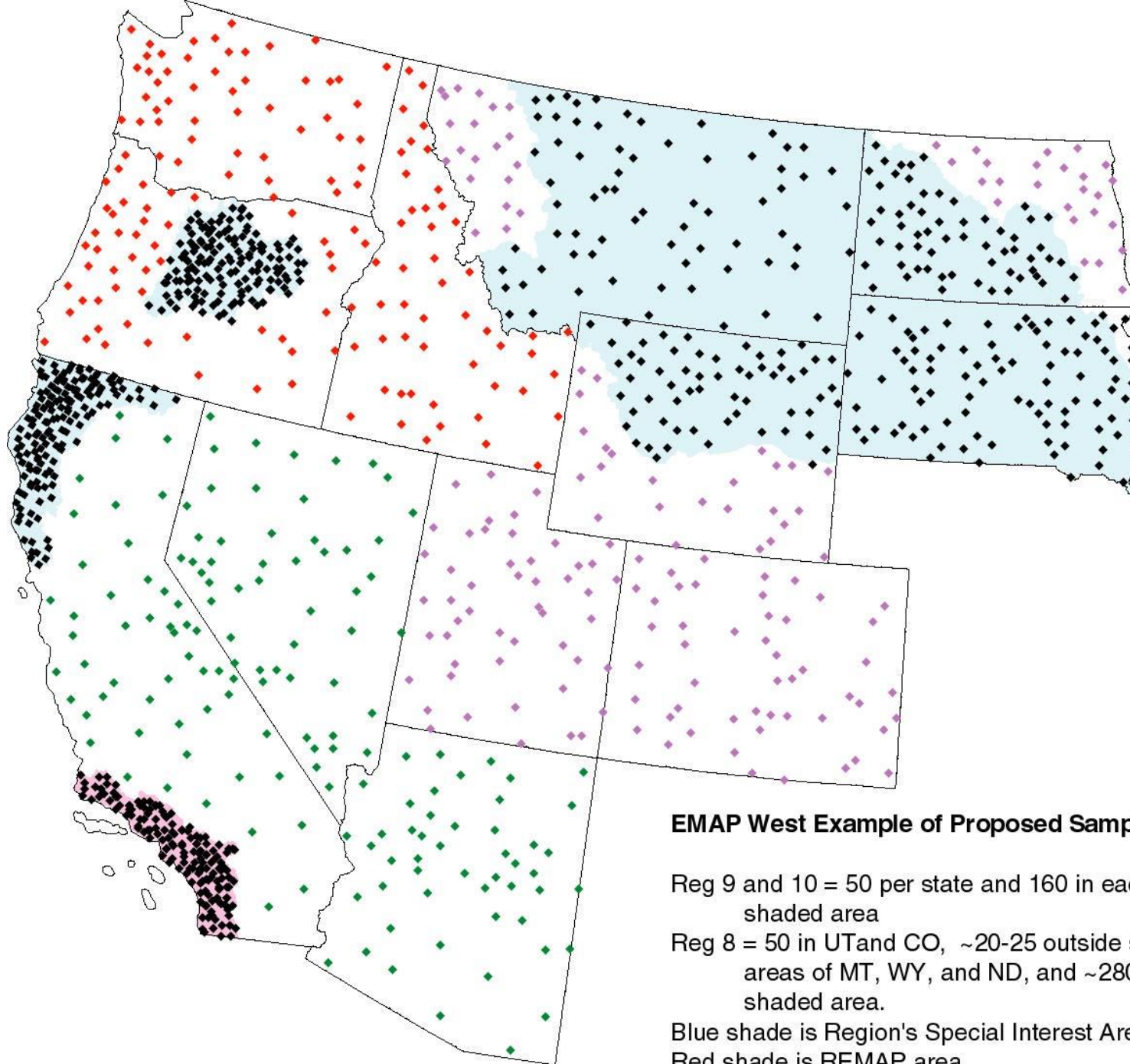
# Western Pilot EMAP and CMAP



CDFW  
U.S. EPA  
SWRCB  
RWQCB







### EMAP West Example of Proposed Sample scheme.

Reg 9 and 10 = 50 per state and 160 in each shaded area

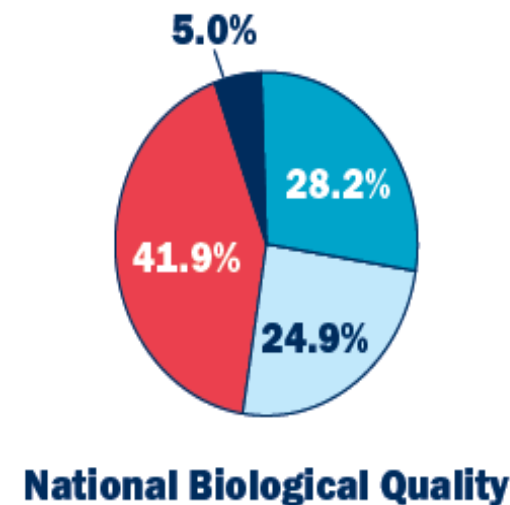
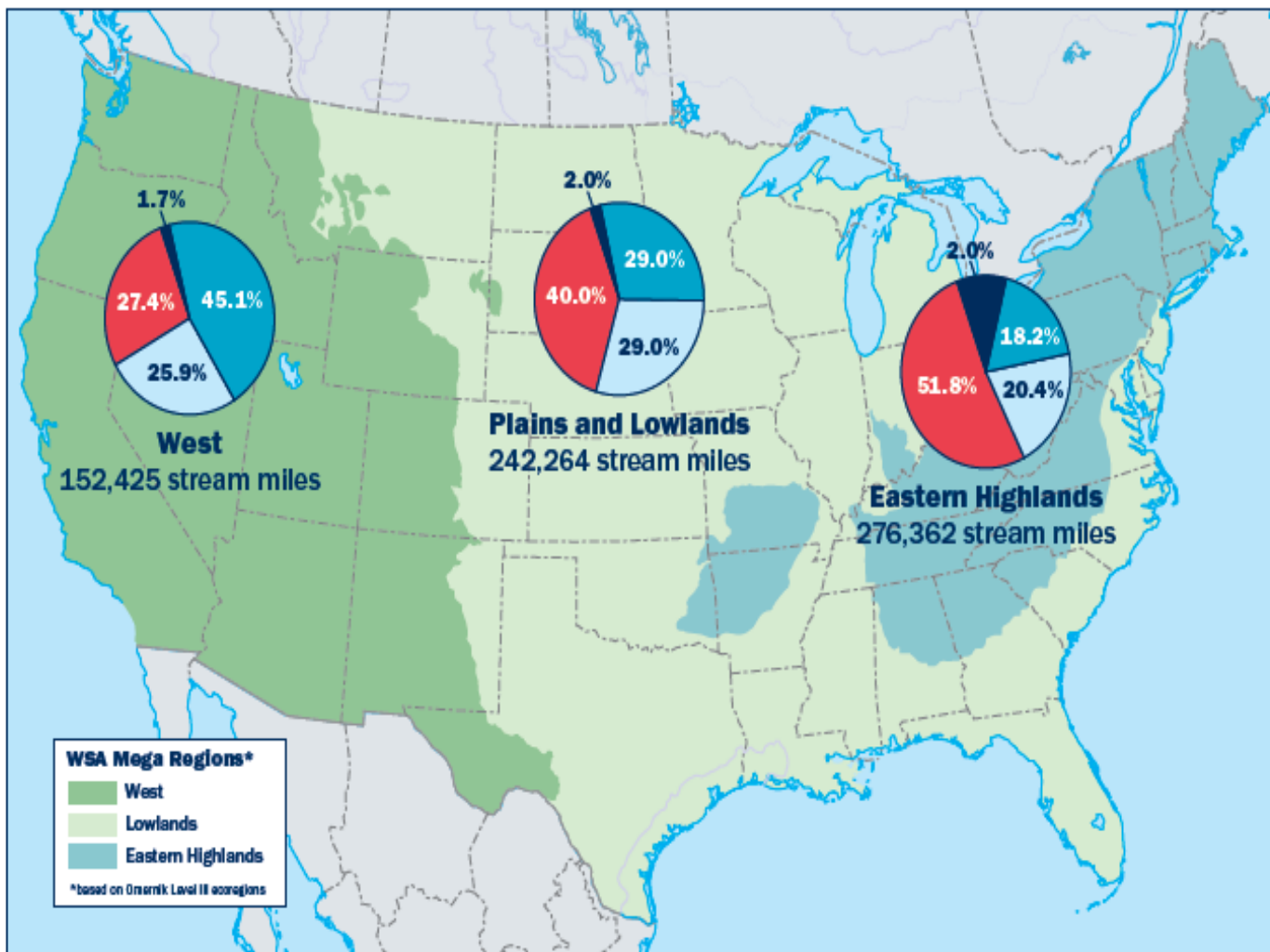
Reg 8 = 50 in UT and CO, ~20-25 outside shaded areas of MT, WY, and ND, and ~280 within shaded area.

Blue shade is Region's Special Interest Areas

Red shade is REMAP area



# Biological condition of our nation's streams (USEPA 2006)



# 2007 CDFW Partnership with SWAMP

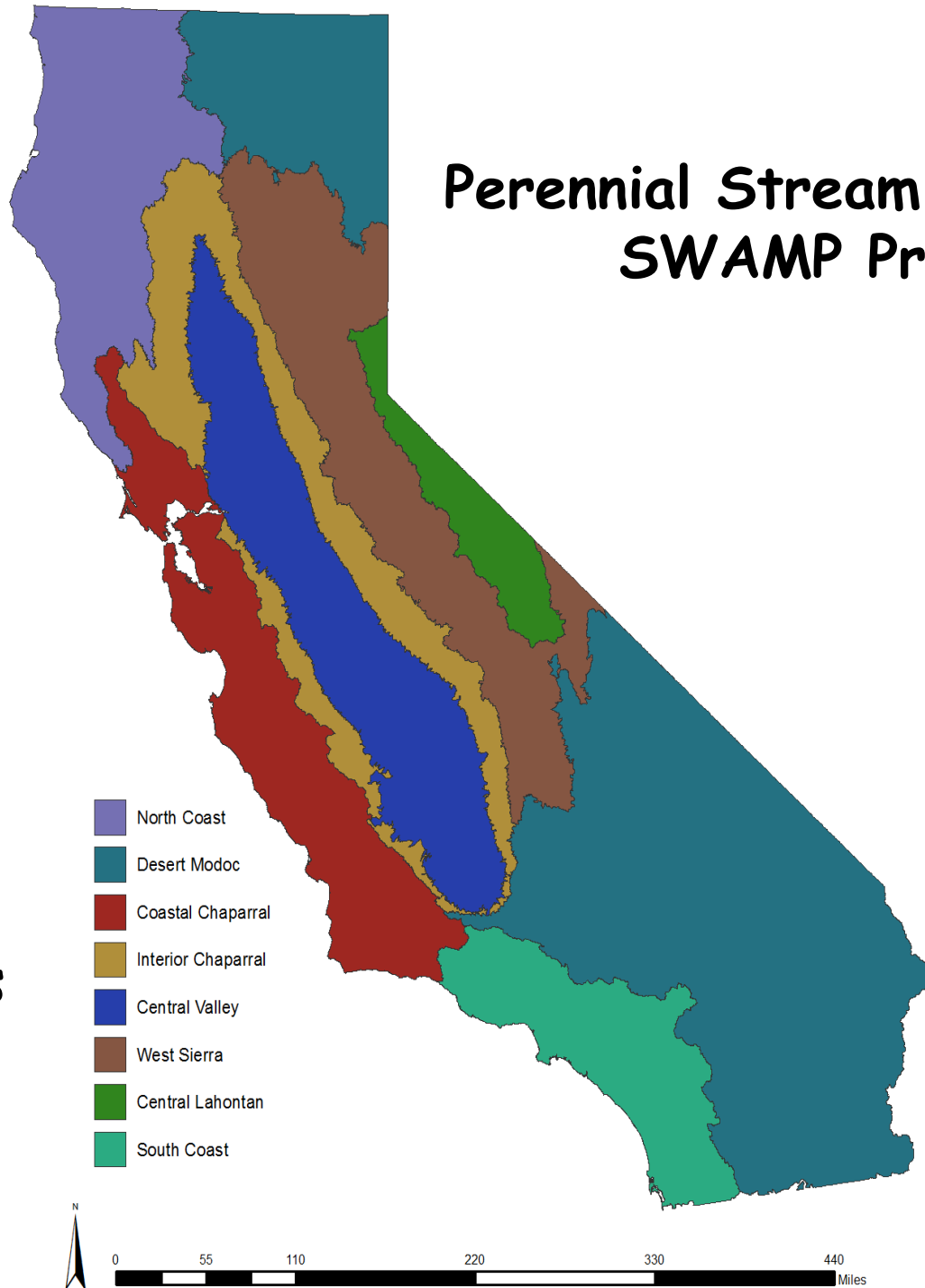
## Surface Water Ambient Monitoring Program



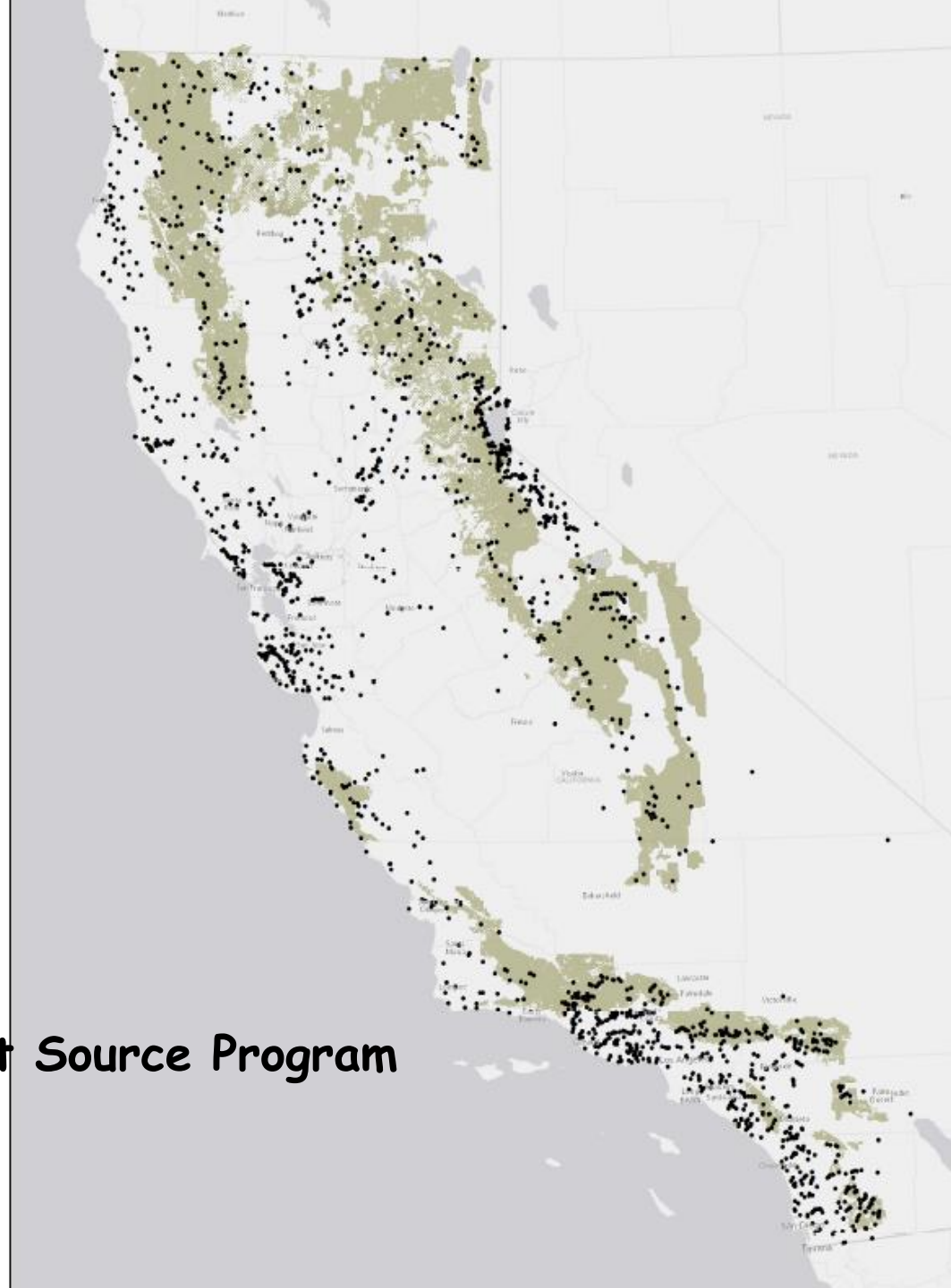


# Perennial Stream Assessment SWAMP Program

## PSA Regions



**More than 2000  
Random Sample Site  
through Combined Programs**



**2000 - 2003 US EPA**

**2004 - 2006 SWRCB Non-point Source Program**

**2007 - 2015 SWAMP**



# Reference Sites

REGION	n
North Coast	75
Central Valley	1
Coastal Chaparral	57
Interior Chaparral	33
South Coast Mountains	85
South Coast Xeric	34
Western Sierra	131
Central Lahontan	114
Deserts + Modoc	27
<b>TOTAL</b>	<b>586</b>





# California Stream Condition Index (CSCI)

A bioassessment tool for perennial  
wadeable streams based on benthic  
macroinvertebrates

Raphael Mazor - SCCWRP

Andy Rehn - ABL

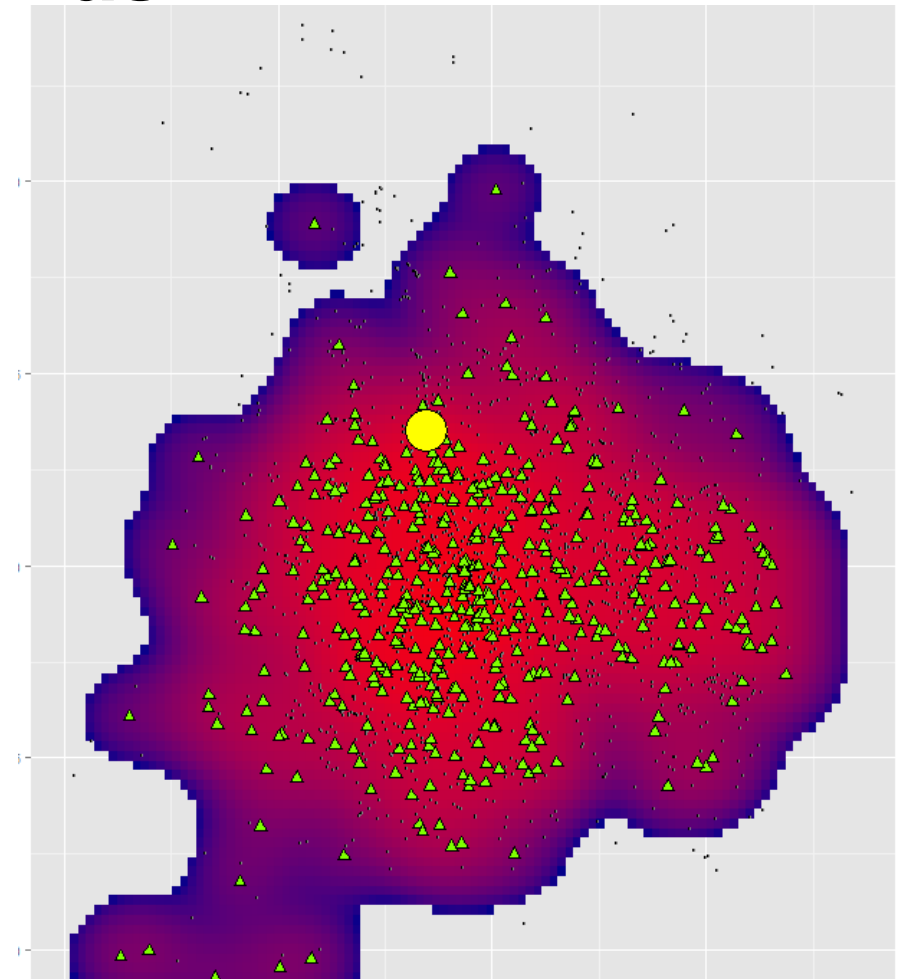
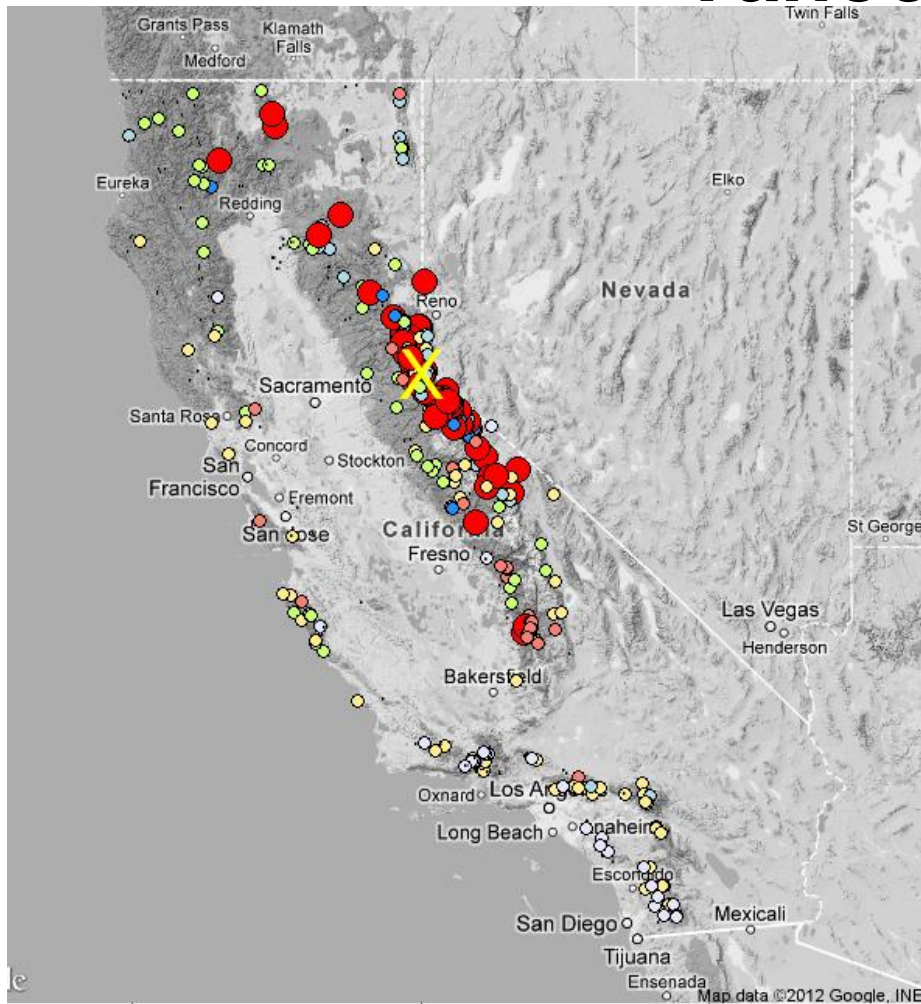
Pete Ode - ABL

[www.sccwrp.org](http://www.sccwrp.org)

[raphaelm@sccwrp.org](mailto:raphaelm@sccwrp.org)



# Trout Creek Tahoe Basin



# Trout Creek Tahoe Basin

Component	Obs	Expect
CSCI	0.65	1
O/E	0.49	1
O	7	14.1
MMI	0.81	1

Metric	Obs	Expect
% Coleoptera taxa	3	4
Diptera taxa	5	5.3
% EPT taxa	24	63
% Intolerant	5	36
% Non-insect	35	3
% Predator taxa	65	26
% Scraper taxa	0	10
% Shredders	0	10
Simpson's diversity	0.90	0.84
Tolerant taxa	6	5

Observed taxa	Missing taxa
Micrasema	Hydropsyche
Sweltsa	Diamesinae
Paraleptophlebia	Fallceon
Oligochaeta	Epeorus
Baetis	Rithrogena
Chironominae	Ameletus
Acari	Cinygmula
Orthocladiinae	Zapada
	Serratella
	Tanypodinae
	Rhyacophila
	Simulium
	Drunella



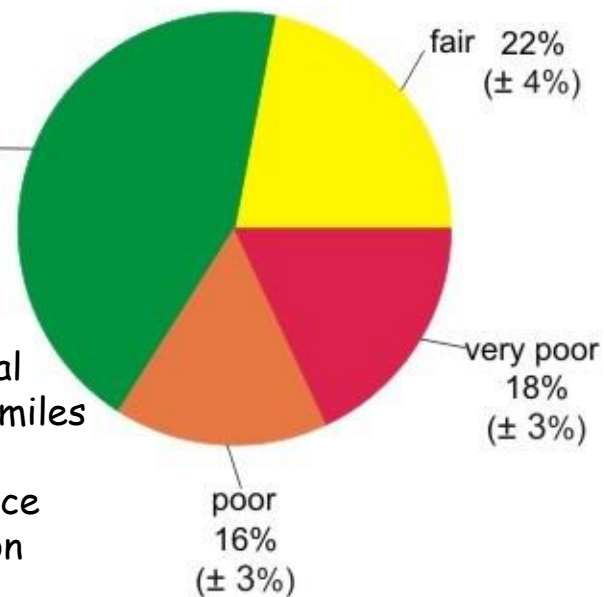
# State's SWAMP Perennial Stream Assessment 2000- 2014

- = good
- = fair
- = poor
- = very poor

good  
44%  
(± 4%)

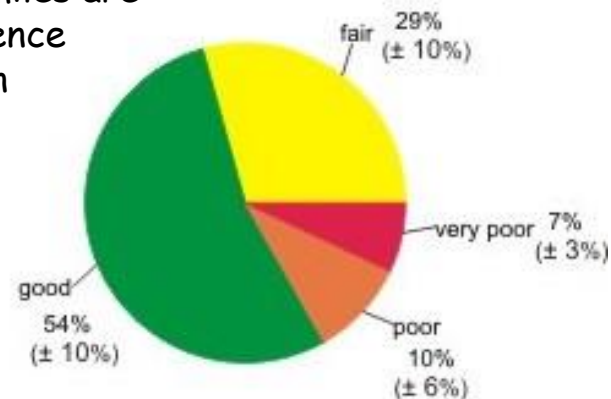
66% of  
perennial  
stream miles  
are in  
reference  
condition

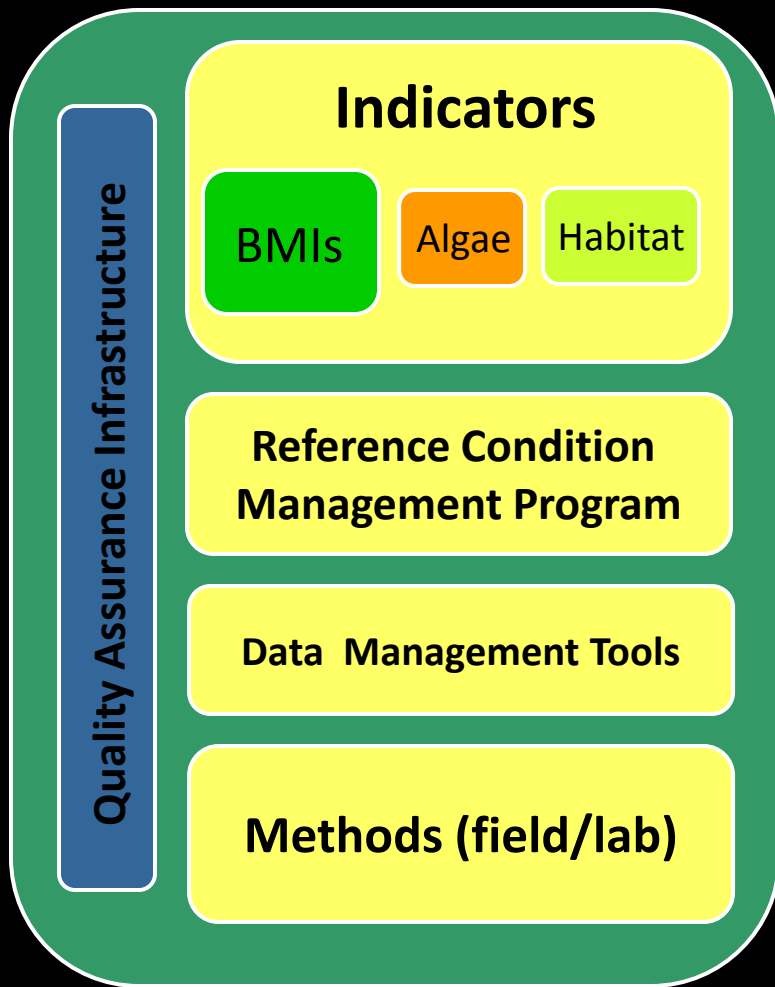
Statewide



83% of perennial  
stream miles are  
in reference  
condition

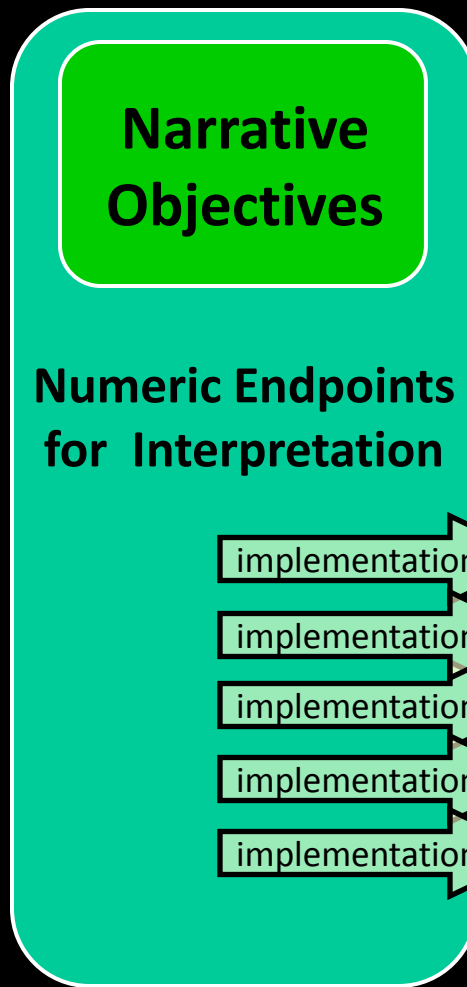
Sierra Nevada





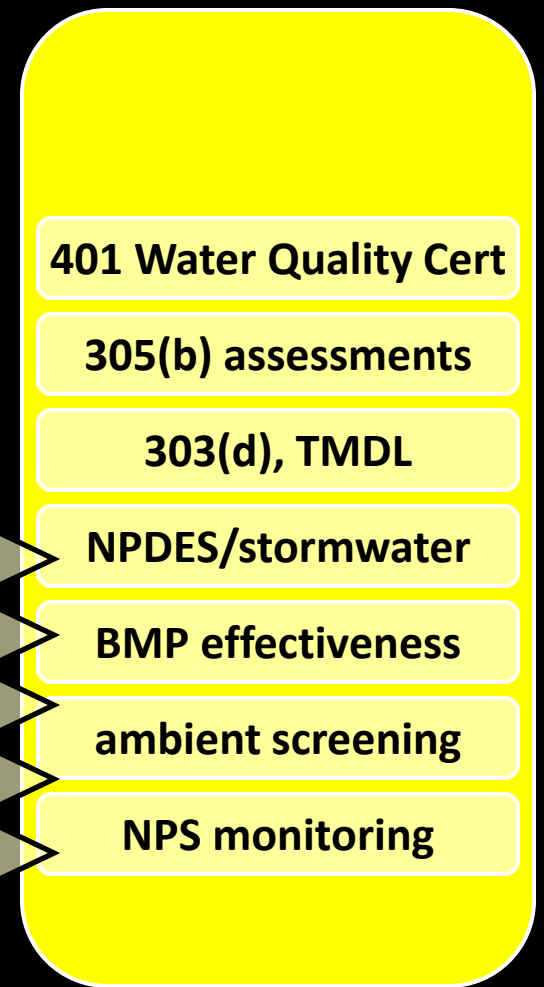
Technical Infrastructure

**SWAMP**



Regulatory Framework

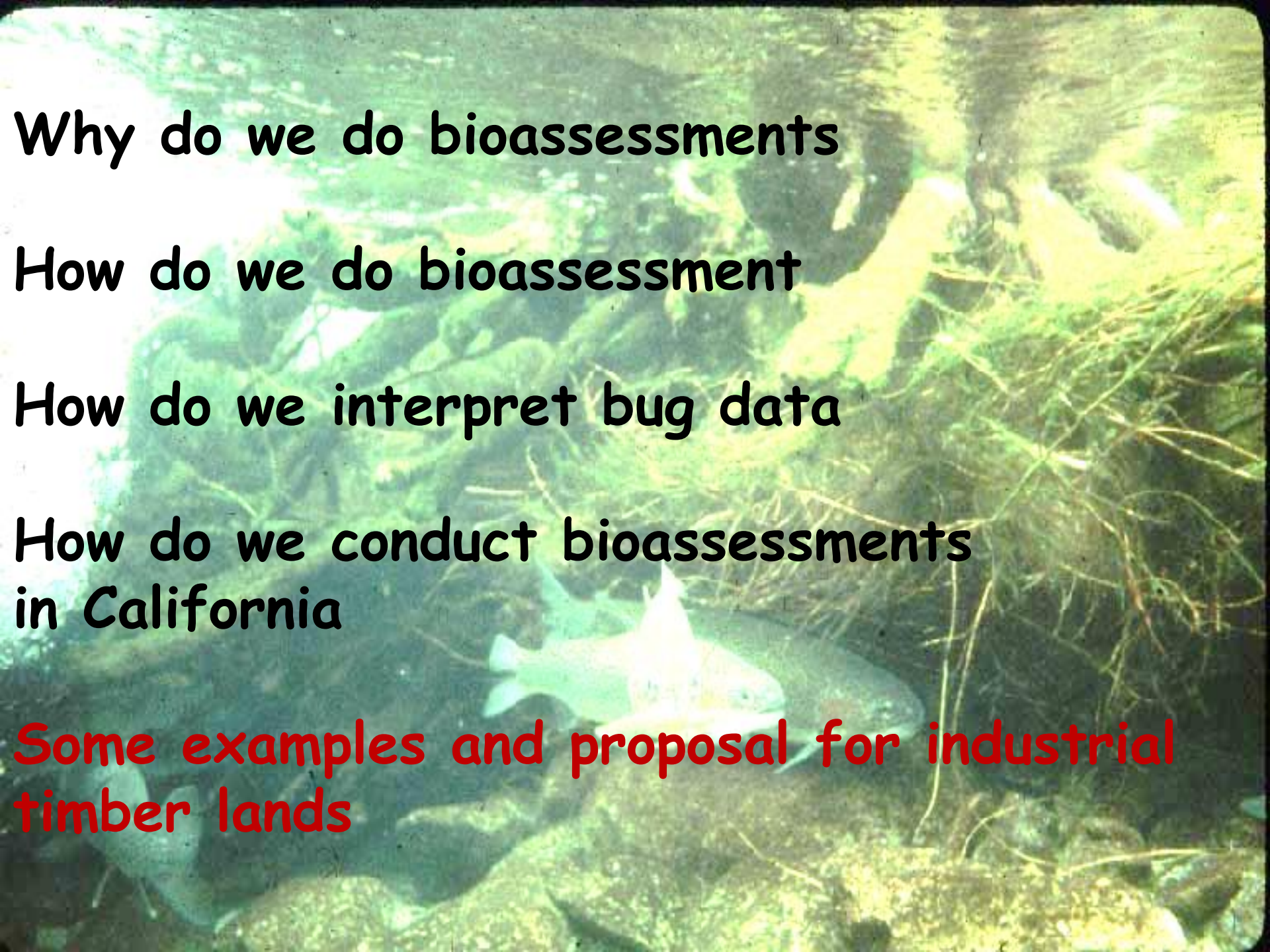
**Standards**



Regulatory Applications

**Regulatory Programs**



An underwater photograph showing a school of fish swimming near a rocky seabed covered in green seaweed. The water is slightly murky, and the lighting is natural, coming from above.

**Why do we do bioassessments**

**How do we do bioassessment**

**How do we interpret bug data**

**How do we conduct bioassessments  
in California**

**Some examples and proposal for industrial  
timber lands**

# USFS Aquatic Management Indicator Species

Lawsuit on EIS saying MIS not effective, No Data

Decided to Change from Trout to BMIs

2009 - first probabilistic sampling event (contractor issues)

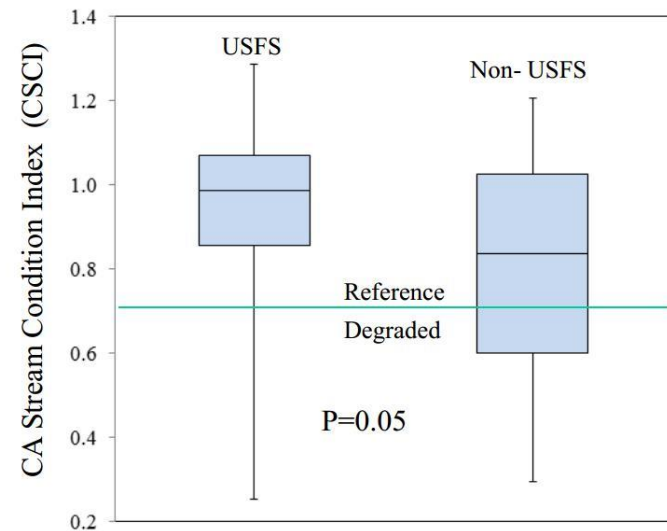
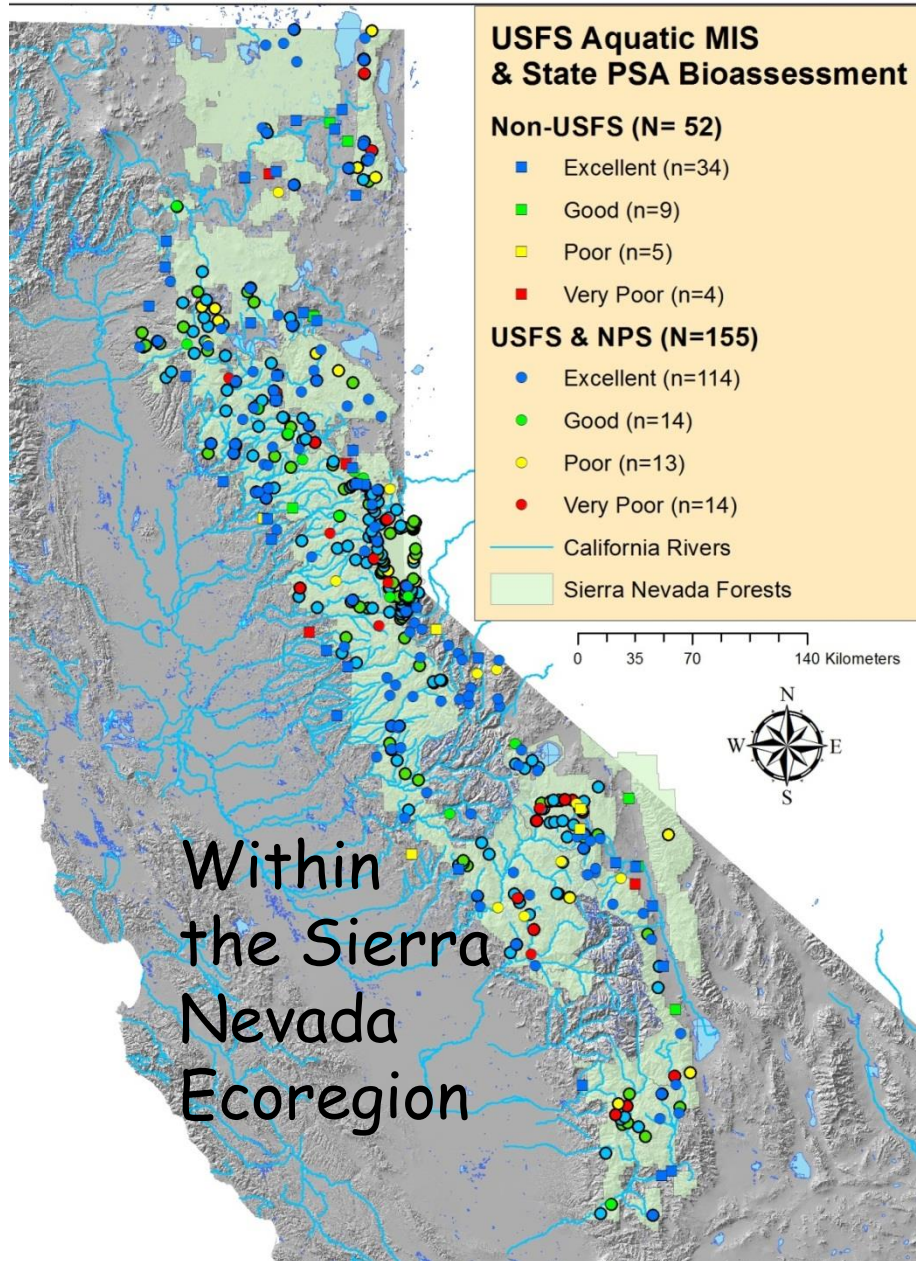
2010 - second probabilistic sampling event (contractor issues)

2011 and 2012 regroup contract with ABL

2013 ABL sampled 21 stream sites incorporated into PSA



# 2013 USFS Aquatic MIS Results



## Based on CSCI Scores

USFS & CDFW combined indicate that  $78 \pm 6\%$  of perennial stream miles on Sierra Nevada National Forests are in reference condition.





**MSG BOF Meeting 9-19-12**  
**Jim Harrington**  
**CDFW Aquatic Bio-Assessment Lab**  
**Cajun James**  
**Sierra Pacific Industries**

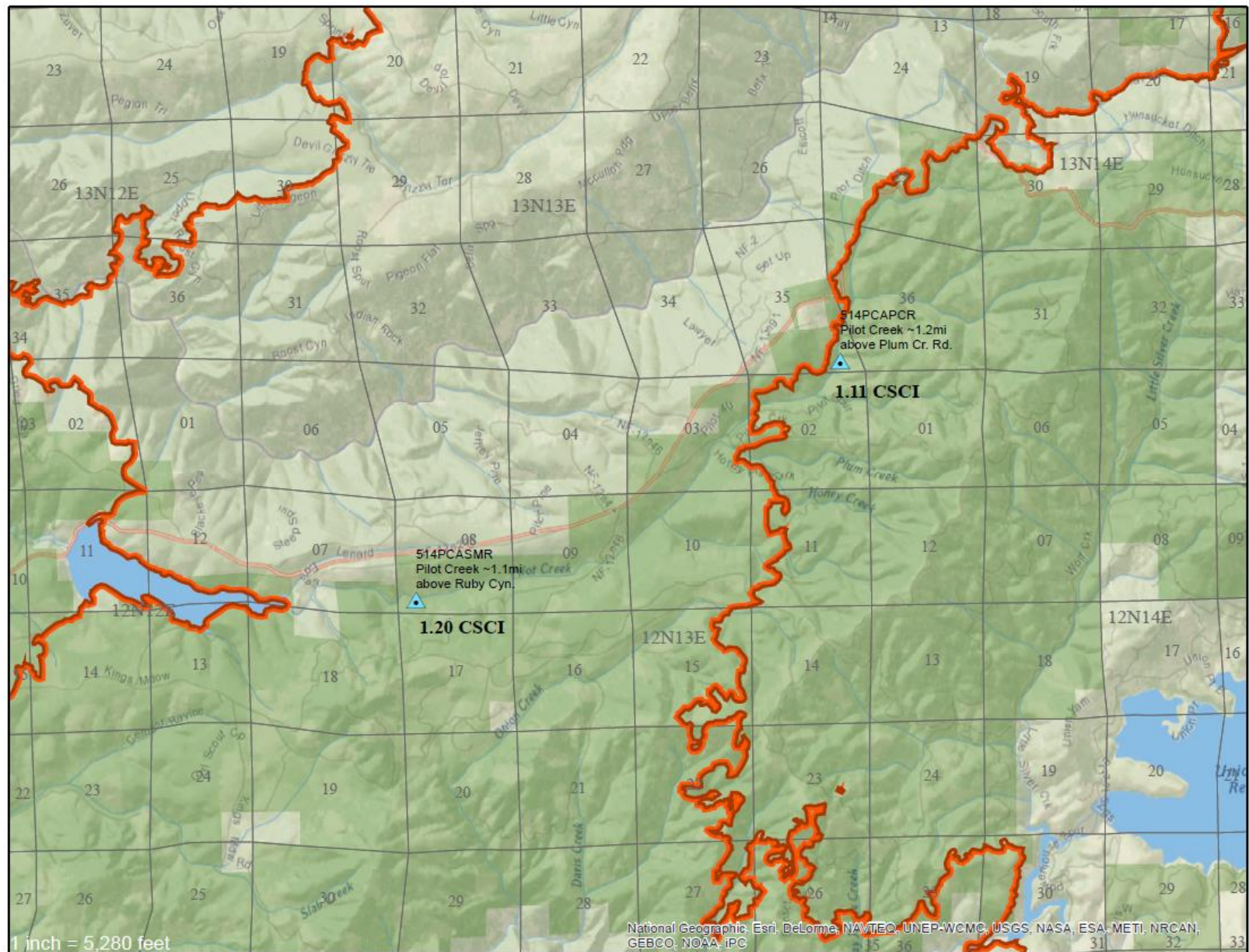
Achieving regulatory biological objectives  
in California



**October 2014**  
**4 Locations Bio-Assessment Protocol**  
**Harrington (Field Staff) & SPI**  
**Greater Battle Creek Working Group (Tussing)**

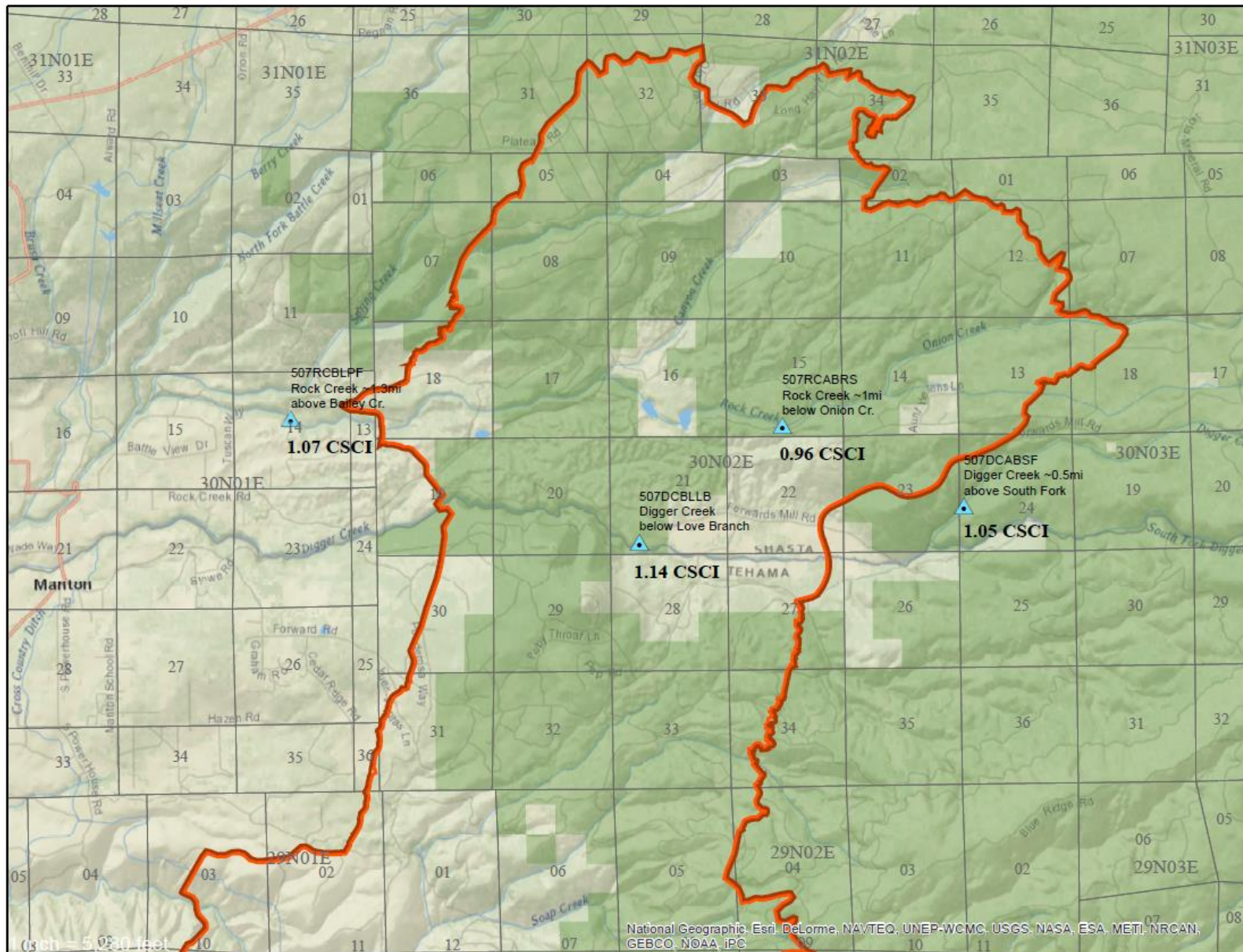


# King Fire Sampling Locations –Above, Within -Pilot Creek





# Ponderosa Fire Sampling Locations-Above, Within, Below





# **Cooperative Pilot Project to Assess Stream Water and Habitat Quality of California Private Forest Lands April 2, 2015**

## **Objective**

The intent of this project is to establish a collaborative monitoring framework for applying California's SWAMP ecological performance measures to evaluate water and habitat quality in streams on private forest lands. Direct collaborators include the State Water Resources Control Board, Department of Fish and Wildlife, Department of Forestry and Fire Protection, California Forestry Association, and private industrial forest owners.

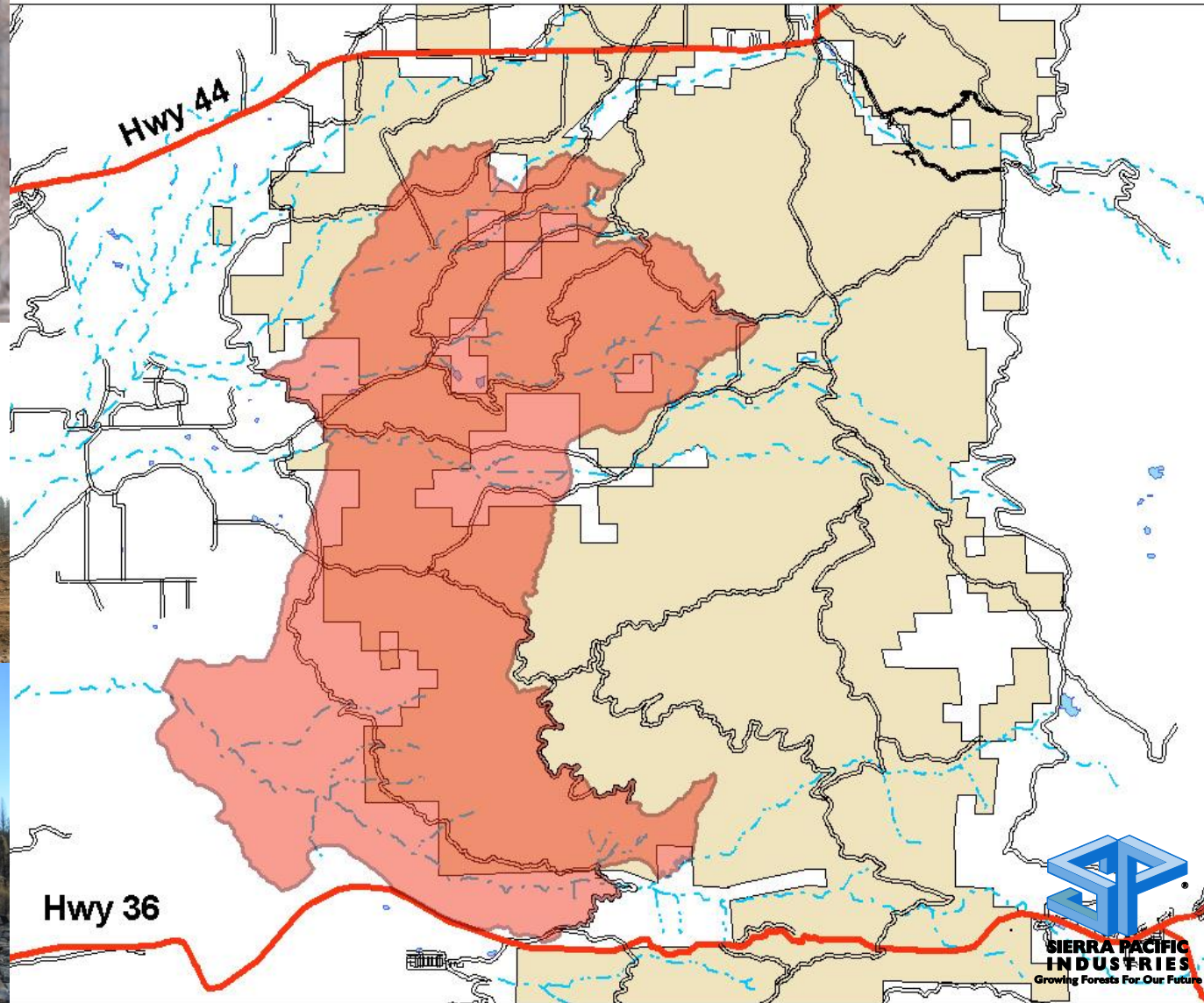
## **Background**

Over the past decade California has adopted ecological performance measures to evaluate resource management practices and support effective regulatory policies. Recently, wadeable streams have been the focus of a large multi-agency effort to develop standardized technical and regulatory tools for measuring and assessing biological integrity as ecological performance measures. The State Water Board is currently developing guidance for the application of these tools that will become part of its Inland Surface Waters and Enclosed Bays and Estuaries Plan.





# Ponderosa Fire – August 2012





So Appreciate  
Your Mayflies





And  
your  
Beetles

